

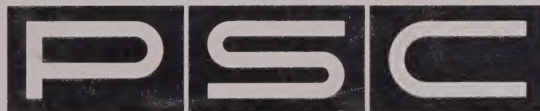
INSTRUCTION MANUAL

112-118

080313

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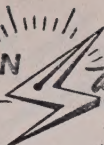
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Standards CORP.

1701 REYNOLDS, SANTA ANA, CALIF. 92705

POWER SUPPLY

MODEL

112 - 118

S.N. 1138

SPECIFICATIONS

MODEL 112

OUTPUT RANGE:	Constant voltage: 0 to 50 volts Constant current: 0 to 3 amps
OUTPUT IMPEDANCE:	DC to 100 Hz: Less than 0.02 ohms 100 Hz to 1 KHz: Less than 0.4 ohms 1 KHz to 1 MHz: Less than 2 ohms
RIPPLE AND NOISE:	Constant voltage: Less than 200 microvolts rms Constant current: Less than 100 microamps rms
LINE REGULATION:	Constant voltage: Less than $0.005\% \pm$ mv for 105 to 130 volts rms change Constant current: Less than $0.005\% \pm$ 400 microamps for 105 to 130 volts rms change
LOAD REGULATION:	Constant voltage: Less than $0.01\% \pm$ 5 millivolts Constant current: Less than $0.05\% \pm$ 500 microamps
OVERLOAD PROTECTION:	Automatic crossover, voltage-to-current or current-to-voltage
TRANSIENT RECOVERY TIME:	Constant voltage: Less than 100 microseconds Constant current: Less than 10 milliseconds
REMOTE PROGRAMMING:	Constant voltage: 0.5k ohms/volt or 0.1 volts/volt Constant current: 667 ohms/amp or 0.367 volts/amp
TEMPERATURE COEFFICIENT:	Constant voltage: $0.05\%/^{\circ}\text{C} \pm$ millivolt Constant current: $0.1\%/^{\circ}\text{C} \pm$ 5.0 milliamps
INPUT:	105 volts rms, 230 watts, to 130 volts rms, 300 watts 50 to 60 Hz

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SECTION 1

SPECIFICATIONS

SPECIFICATIONS MOD 104

OUTPUT RANGE:

Constant voltage: 0 to 10 volts
Constant current: 0 to 10 amps

OUTPUT IMPEDANCE:

DC to 100 Hz: Less than 0.005 ohms
100 Hz to 1 KHz: Less than 0.1 ohms
1 KHz to 1 MHz: Less than 2 ohms

RIPPLE AND NOISE:

Constant voltage: Less than 100 microvolts rms
Constant current: Less than 250 microamps rms

LINE REGULATION:

Constant voltage: Less than 0.005%+1 mv for 105 to 130 volts rms change
Constant current: Less than 0.005%+500 microamps for 105 to 130 volts rms change

LOAD REGULATION:

Constant voltage: Less than 0.01%+1 millivolts
Constant current: Less than 0.05%+1.25 milliamps

OVERLOAD PROTECTION:

Automatic crossover, voltage-to-current or current-to-voltage

TRANSIENT RECOVERY TIME:

Constant voltage: Less than 50 microseconds
Constant current: Less than 10 milliseconds

REMOTE PROGRAMMING:

Constant voltage: 2.5k ohms/volt or 0.4 volts/volt
Constant current: 200 ohms/amp or 0.1 volts/amp

TEMPERATURE COEFFICIENT:

Constant voltage: 0.05%/°C+200 microvolts
Constant current: 0.1%/°C+12.5 milliamps

OPERATING TEMPERATURE:

Range 0 to +50°C

INPUT:

105 volts rms, 160 watts, to 130 volts rms, 200 watts, 50 to 60 Hz

SPECIFICATIONS MOD 105

OUTPUT RANGE:

Constant voltage: 0 to 20 volts
Constant current: 0 to 5 amp

OUTPUT IMPEDANCE:

DC to 100 Hz: Less than 0.01 ohms
100 Hz to 1 KHz: Less than 0.2 ohms
1 KHz to 1MHz: Less than 2 ohms

RIPPLE AND NOISE:

Constant voltage: Less than 150 microvolts rms
Constant current: Less than 125 microamps rms

LINE REGULATION:

Constant voltage: Less than $0.005\% \pm 1$ mv for 105 to 130 volts rms change
Constant current: Less than $0.005\% \pm 625$ microamps for 105 to 130 volts rms change

LOAD REGULATION:

Constant voltage: Less than $0.01\% \pm 2$ millivolts
Constant current: Less than $0.05\% \pm 625$ microamps

OVERLOAD PROTECTION:

Automatic crossover, voltage-to-current or current-to-voltage

TRANSIENT RECOVERY TIME:

Constant voltage: Less than 75 microseconds
Constant current: Less than 10 milliseconds

REMOTE PROGRAMMING

Constant voltage: 1.25k ohms/volt or 0.25 volts/volt
Constant current: 400 ohms/amp or 0.2 volt/amp

TEMPERATURE COEFFICIENT:

Constant voltage: $0.05\%/^{\circ}\text{C} \pm 400$ microvolts
Constant current: $0.1\%/^{\circ}\text{C} \pm 6.25$ milliamps

OPERATING TEMPERATURE:

Range 0 to $+50^{\circ}\text{C}$

INPUT:

105 volts rms, 160 watts, to 130 volts rms, 200 watts, 50 to 60 Hz

SPECIFICATIONS MOD 106

OUTPUT RANGE:

Constant voltage: 0 to 50 volts
Constant current: 0 to 2 amps

OUTPUT IMPEDANCE:

DC to 100 Hz: Less than 0.02 ohms
100 Hz to 1 KHz: Less than 0.4 ohms
1 KHz to 1MHz: Less than 2 ohms

RIPPLE AND NOISE:

Constant voltage: Less than 200 microvolts rms
Constant current: Less than 50 microamps rms

LINE REGULATION:

Constant voltage: Less than $0.005\% \pm 1$ mv for 105 to 130 volts rms change
Constant current: Less than $0.005\% \pm 100$ microamps for 105 to 130 volts rms change

LOAD REGULATION:

Constant voltage: Less than $0.01\% \pm 5$ millivolts
Constant current: Less than $0.05\% \pm 250$ microamps

OVERLOAD PROTECTION:

Automatic crossover, voltage-to-current or current-to-voltage

TRANSIENT RECOVERY TIME:

Constant voltage: Less than 100 microseconds
Constant current: Less than 10 milliseconds

REMOTE PROGRAMMING:

Constant voltage: 0.5k ohms/volt or 0.1 volts/volt
Constant current: 1k ohms/amp or 0.5 volts/amp

TEMPERATURE COEFFICIENT:

Constant voltage: $0.05\%/^{\circ}\text{C} \pm 1$ millivolt
Constant current: $0.1\%/^{\circ}\text{C} \pm 2.5$ milliamps

OPERATING TEMPERATURE:

Range 0 to 50°C

INPUT:

105 volts rms, 160 watts, to 130 volts rms, 200 watts, 50 to 60 Hz

SECTION 2

GENERAL INFORMATION

2.1 INSPECTION

When the unit is received, the customer should inspect it for any shipping damage. Remove the top cover of the unit to inspect the printed circuit boards. The printed circuit boards should be removed, inspected and replaced in their proper slots, one at a time. The component side of each board should be facing the front of the module. Do not alter the controls on the printed circuit boards; if any control is moved, the unit will be out of calibration.

2.2 SHIPPING KIT

The shipping kit should be inspected when the unit is received and should include the following:

- One power cord
- One set of unassembled patch pins
- One shorting bar

2.3 MOUNTING

MOD power sources are designed to be used as single power units or incorporated with other MODS into optional racks.

NOTE: Before installing the modules into racks, remove the handles. Also remove the patch plate from the rack which blocks air flow into the unit.

2.4 CONNECTORS

A 3-pin connector is used for the AC power input. Connections are provided on the front panel and the rear patchboard connector for ground and the plus (+) and minus (-) outputs. The rear patchboard also provides all additional connections for remote programming and sensing.

2.5 PATCH PIN ASSEMBLY

The shipping kit contains a set of unassembled patch pins. Figure 2-1 shows the proper way to assemble the patch pins.

2.6 INITIAL OPERATION

Prior to the application of power, insure that the unit is protected by a fuse located at the rear of the module.

The unit is programmed for normal operation by the patch cords at the rear patchboard connector at the factory. These patch cords should not be removed until another mode of operation is desired.

Plug the AC line cord into a 115 volt 60 Hz source and turn the POWER switch to the ON position. Set the METER switch to VOLT and observe the front panel meter. Insure that the voltage can be controlled in a range from zero volts to the maximum rated output voltage of the unit.

Set the METER switch to CUR and short the power supply output. Insure that the current can be controlled in a range from zero amperes to the maximum output current of the unit.

2.7 COOLING

For proper operation, the air surrounding the unit should be maintained between 0°C and +50°C, with a relative humidity not to exceed 70%. When racks are used, it is recommended that flushing fans be used (MOD fan module).

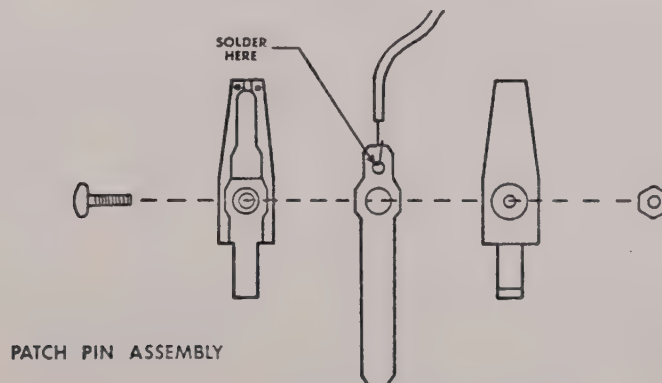


FIGURE 2-1

SECTION 3

THEORY OF OPERATION

MOD power sources are all-silicon voltage and current regulated modules. The units are designed to operate on a line voltage ranging from 105 to 130 volts AC at a line frequency ranging from 50 to 60 Hz.

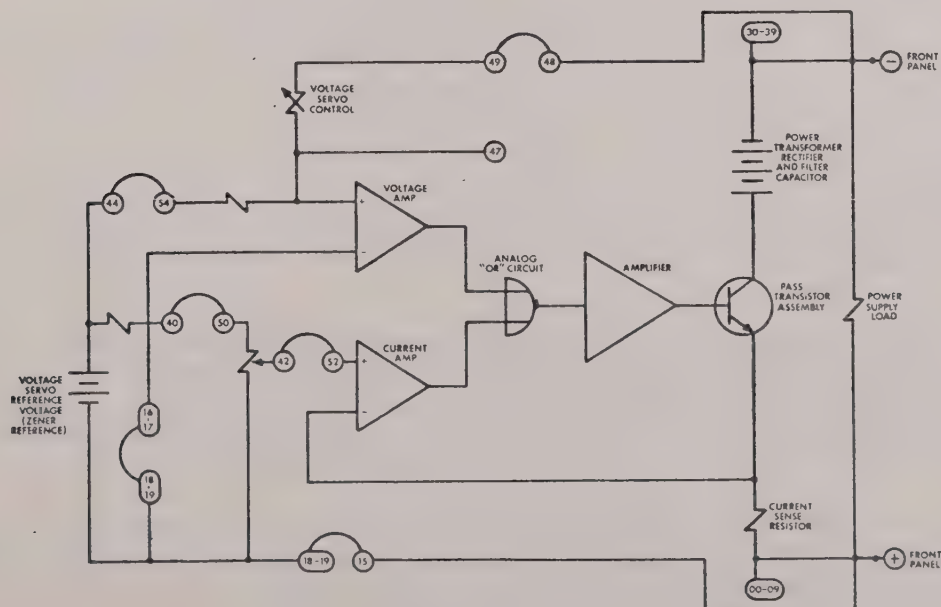
The power source consists of six basic elements: (1) the power transformer, rectifier and filter, (2) an auxiliary DC supply, (3) a reference, with voltage and current amplifiers, (4) the automatic crossover circuit, (5) an optional overvoltage crowbar circuit, and (6) the series control element.

The line voltage is connected to the primary of transformer T1; the output of secondary No. 1 of T1 is connected to an AC-to-DC conversion unit. The conversion unit consists of a fullwave bridge rectifier and a large capacitor. The positive (+) output is connected to the positive output terminal via the series control element. The negative (-) output is connected directly to the negative output terminal.

The auxiliary DC supply power is supplied by secondary No. 2 of transformer T1 and rectified by a full-wave bridge and filtered by capacitor C3. The auxiliary DC supply provides a regulated plus (+) 13 volts and minus (-) 13 volts (with respect to the positive (+) output of the unit) to the regulator board.

The regulator board consists of a voltage and current reference, two low-drift differential amplifiers (one for voltage and one for current), an analog OR circuit, and a driver amplifier for the series control element. The voltage servo is connected in an operational configuration and the current servo is connected in a potentiometric configuration. The analog OR circuit provides automatic crossover from voltage-to-current and current-to-voltage regulation. The most negative voltage to the two inputs of the analog OR circuit determines the mode of regulation. The supply may operate in both modes simultaneously if the inputs to the analog OR circuit are of an equal magnitude.

The optional overvoltage crowbar circuit consists of an adjustable level detector and a silicon controlled rectifier (SCR). The purpose of the overvoltage crowbar is to protect external equipment from possible power supply failure or the operator from tuning the voltage up too high. When the voltage reaches a pre-selected point the SCR is turned on and the output of the supply is short-circuited. In order to return the supply to normal operation, adjust the voltage control to zero volts and then back to the desired voltage.



MOD POWER SUPPLY BLOCK DIAGRAM
FIGURE 3-1

SECTION 4

OPERATING INSTRUCTIONS

4.1 NORMAL FRONT PANEL OPERATION

For "normal operation" (front panel operation): Jumper between 15 and 16, 17 and 18, 40 and 50, 42 and 52, 44 and 54, 48 and 49; as shown in Figure 4-1.

The MOD Power Supplies, as shipped from the factory, are wired for "normal" power supply operation. The metal strap on the front panel binding posts should be connected between the chassis ground and the low side of the power supply to reduce the output noise. In the "normal" power supply operating mode, the sense leads are connected to the front panel binding posts. The unit, when in operation, will function as a constant voltage power supply at the voltage set by the front panel voltage control knobs. As the output or load current is increased, the unit will automatically crossover to a constant current mode of operation. The point of crossover from constant voltage to constant current is set by the current control knobs on the front panel. To obtain the best regulation in the constant current mode of operation, the meter switch should be in the "current" position. (Note: The meter can draw up to 100 microamps from the power supply output current if the meter switch is in the VOLTAGE position. This will reduce the degree of current regulation by 100 microamps.)

To set the constant current point, set the meter switch to "current," short the output terminals of the supply together and adjust the current control knobs for the required current as indicated by the meter.

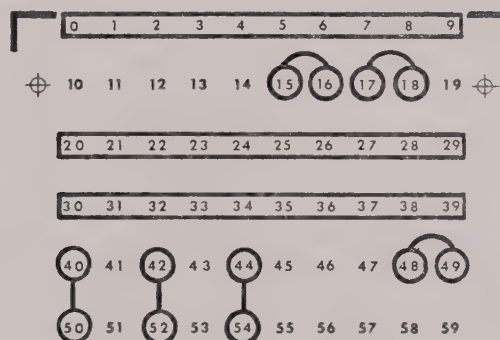


FIGURE 4-1

4.2 EXTERNAL VOLTAGE SENSE

For external voltage sense: Jumper between 17 and 18, 40 and 50, 42 and 52, 44 and 54; 16 is (+) sense lead, 49 is (-); see Figure 4-2.

The sense leads must be connected to the correct polarity at the load. The sense leads will draw less than 2 milliamps, but a finite voltage drop will occur in the sense leads due to the sense current. Adequate precautions should be taken with regard to the sense lead length and wire size based on 2 milliamps of sense current and the degree of voltage regulation required at the load. The voltage drop between the output of the power supply and the load should not exceed 1 volt.

In order to minimize noise pickup in the sense leads, they should either be twisted together or shielded. The low side of the power supply should be connected to chassis ground either at the front panel or the rear panel. If rear panel connection is desired, connect a jumper between Pin 20 (20 through 29) and the low output side of the power supply, Pin 00 (00 through 09) for (+) voltage, or Pin 30 (30 through 39) for (-) voltage.

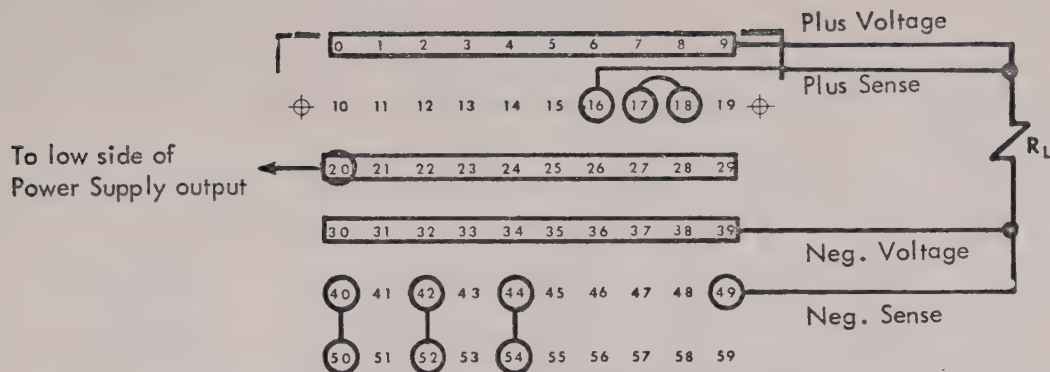


FIGURE 4-2

4.3 VOLTAGE PROPORTIONAL TO RESISTANCE

Voltage proportional to an external resistance value: Jumper between 15 and 16, 17 and 18, 40 and 50, 42 and 52, 44 and 54; connect external resistor between 47 and 48; see Figure 4-3.

The external resistance is connected between Pin 47 and the negative supply voltage; i.e., Pin 48 for front panel operation. The connection from the external resistance to the negative supply voltage is the (-) sense lead. The output voltage will change according to the value of external resistance used as shown below:

MOD 104

2.5k ohms/volt

MOD 105

1.25k ohms/volt

MOD 106

0.5k ohms/volt

The accuracy of the output voltage versus resistance is $\pm 10\%$. Greater accuracy ($\pm 1\%$) can be obtained by recalibrating the power supply internally. This is accomplished by connecting the desired resistance to the power supply and adjusting Pot R-23 on the first plug-in printed circuit board for the absolute voltage required. If a switch is used to select external resistance values, a make-before-break switch should be used. If the resistor is momentarily removed from the circuit, the output of the supply will increase, momentarily, to its maximum output voltage. In order to minimize noise pickup in the leads to the external resistor, the leads should be twisted or shielded. The low side of the power supply output should be connected to ground.

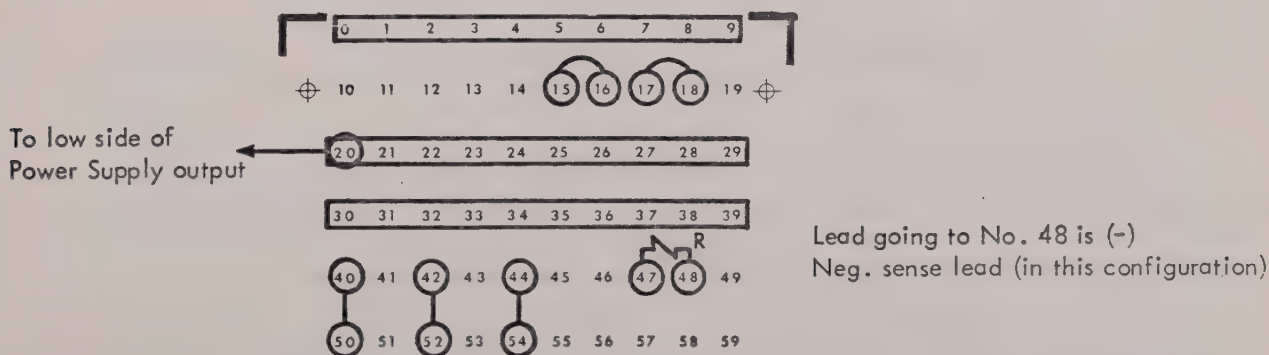


FIGURE 4-3

4.4 VOLTAGE PROPORTIONAL TO VOLTAGE REFERENCE

Voltage proportional to an external control voltage: Jumper between 18 and 54, 40 and 50, 42 and 52, 48 and 49; connect 15 and 19 to (+) side of reference voltage; connect 17 to (-) side of reference voltage; see Figure 4-4.

The output voltage will change according to the value of external control voltage as shown below:

<u>MOD 104</u>	<u>MOD 105</u>	<u>MOD 106</u>
0.4 volts/volt	0.25 volts/volt	0.1 volts/volt

To calibrate the unit, apply the required control voltage for full supply output voltage and adjust the front panel voltage control knobs for the specified output voltage from the supply. The input resistance, as seen by the external control voltage source, is greater than 1 megohm. The source resistance of the external control voltage source should be less than 1k ohms to obtain the specified power supply stability. Precautions should be taken to avoid pickup in the external leads. The low side of the power supply output should be connected to ground.

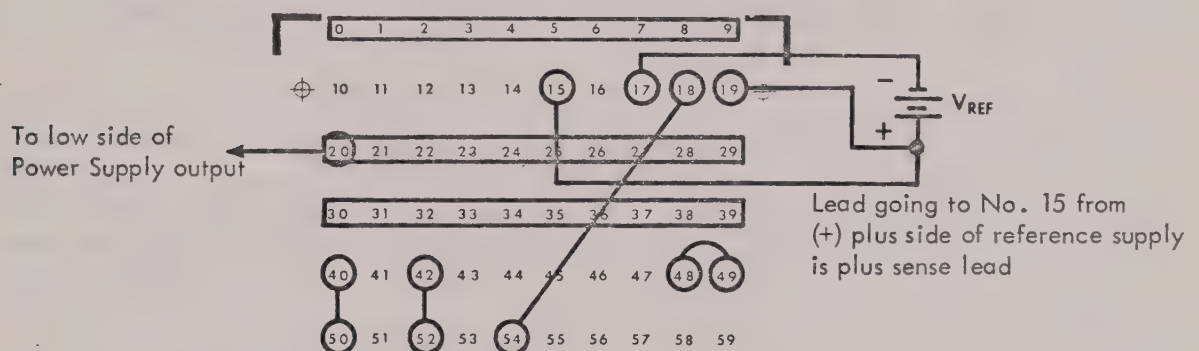


FIGURE 4-4

4.5 CURRENT PROPORTIONAL TO RESISTANCE

Current proportional to an external resistance value: Jumper between 15 and 16, 17 and 18, 44 and 54, 48 and 49; connect 40 and 52 to one side of resistor and 19 to other side; see Figure 4-5.

<u>MOD 104</u>	<u>MOD 105</u>	<u>MOD 106</u>
0.2k/amp	0.4k/amp	1k/amp

The accuracy of the output current versus resistance is $\pm 10\%$. Greater accuracy can be obtained by recalibrating the power supply internally. This is accomplished by connecting the desired resistance to the power supply and adjusting Pot R-22 on the first plug-in printed circuit board for the absolute current required. The output current versus resistance is slightly non-linear, but will vary less than $\pm 10\%$ from the best straight line drawn through the response curve. If a switch is used to select external resistance values, a make-before-break switch should be used. If the resistor is removed from the circuit, or too large a value is selected, the power supply will not be short-circuit current limited and may be destroyed.

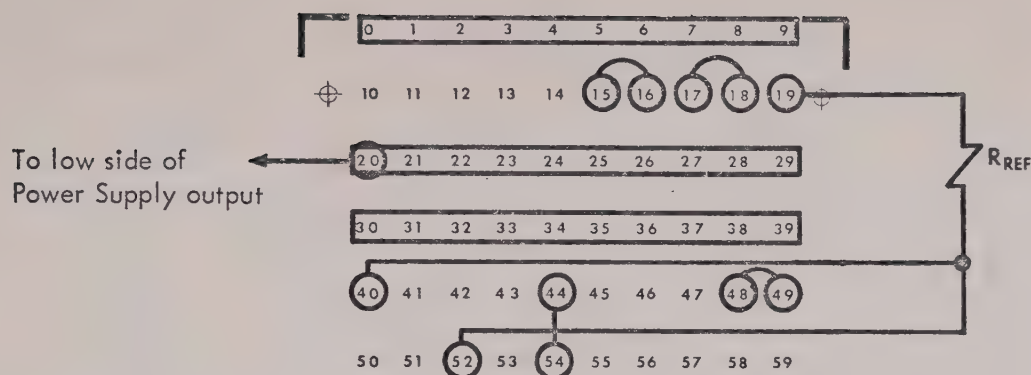


FIGURE 4-5

4.6 CURRENT PROPORTIONAL TO VOLTAGE REFERENCE

Current proportional to an external control voltage: Jumper between 15 and 16, 17 and 18, 40 and 50, 44 and 54, 48 and 49. Connect 52 to (+) side of reference voltage; connect 19 to (-) side of reference voltage; Figure 4-6.

The accuracy of the output current versus external control voltage is $\pm 2\%$ of the rated supply current. The input resistance, as seen by the external control voltage source, is greater than 1 megohm. The source resistance of the external control voltage source should be less than 1k ohms to obtain the specified power supply stability. If the external control voltage exceeds the specified value, the power supply will not be short-circuit current limited and may be destroyed.

Precautions should be taken to avoid pickup in the external leads. The low side of the power supply output should be connected to ground.

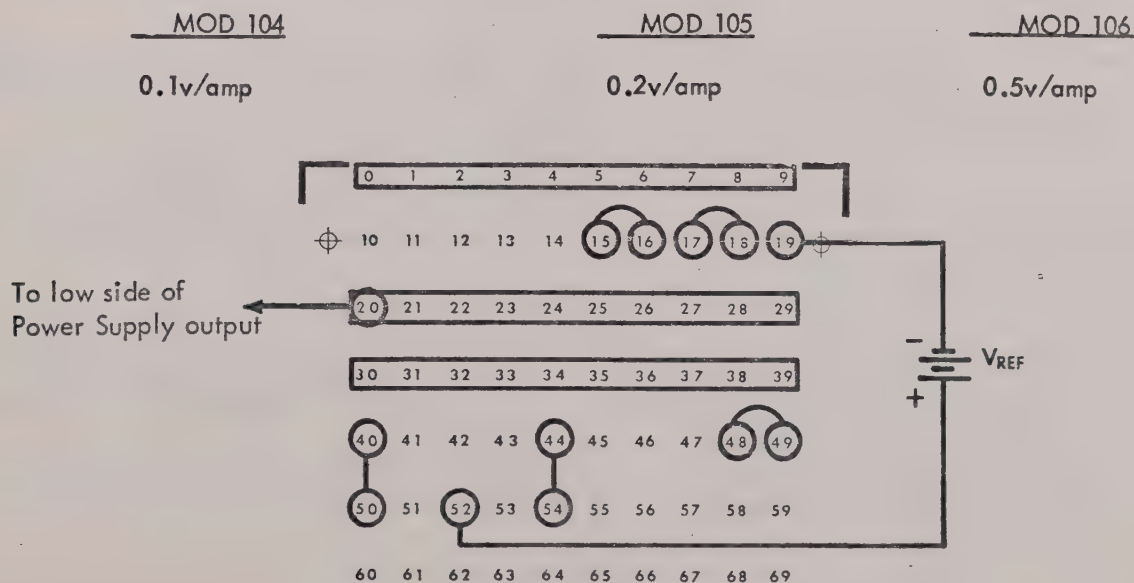
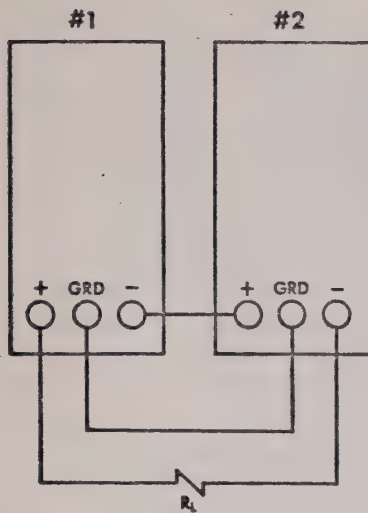
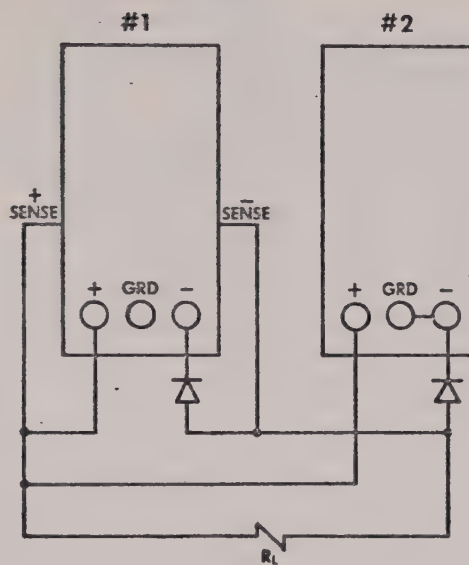


FIGURE 4-6

SERIES OPERATION



PARALLEL OPERATION



REAR PATCH CONNECTIONS

#1	#2
16(+ Sense)	15 to 16
17 to 18	17 to 18
40 to 50	40 to 50
42 to 52	42 to 52
44 to 54	44 to 54
49(-Sense)	48 to 49

Diodes are 1N1191R or equivalent

SERIES AND PARALLEL OPERATION OF MOD POWER SUPPLIES

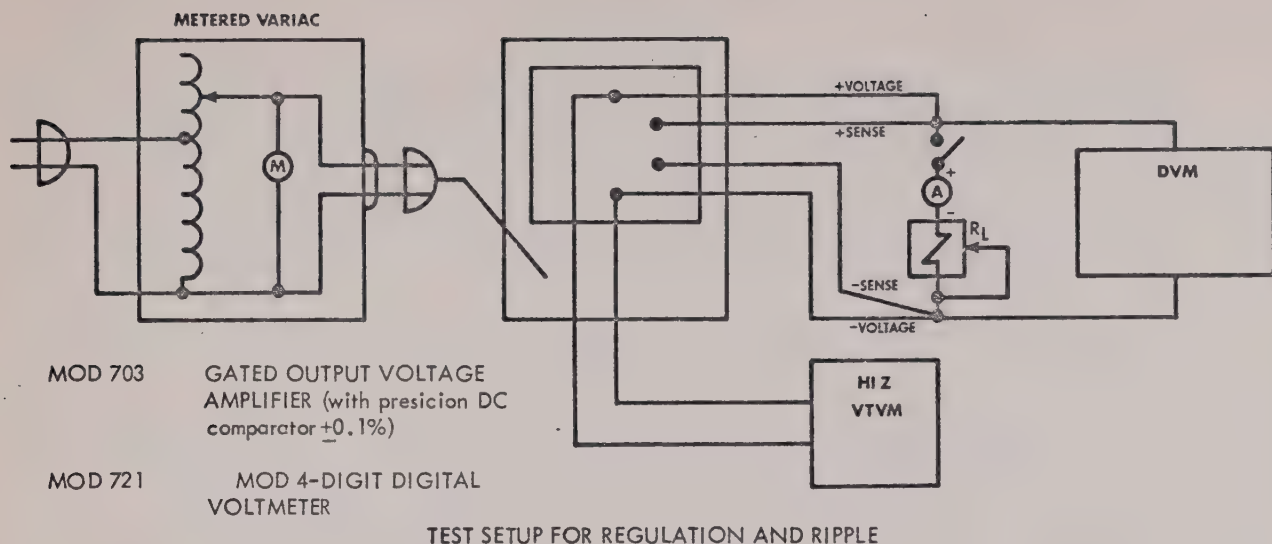
SECTION 5

REGULATION AND RIPPLE CHECK

1. Connect the power supply AC input to metered variac or variable auto-transformer.
2. Connect load resistor to the output terminals of the power supply through a switch and DC ammeter. The load resistor should be such that the rated load current is obtained with rated output voltage.
3. Connect a differential voltmeter or digital voltmeter DIRECTLY to the power supply output terminals. The differential voltmeter must not be connected to the load or to the wires going to the load.
4. Connect an AC vacuum tube voltmeter with shielded leads to the output terminals of the power supply.
5. LOAD REGULATION:
 - a. Adjust the variac for 115 volts as indicated by the variac.
 - b. Close load switch and adjust load resistor for rated output current as indicated by the DC ammeter, with the power supply output set at rated voltage.
 - c. The load regulation can be measured by alternately opening and closing the switch and observing the voltage change on the differential voltmeter.
6. LINE REGULATION:

With rated output current SW1 closed, vary the line voltage as indicated by the variac from 105 to 130 volts AC. The line regulation can be observed on the differential voltmeter.
7. RIPPLE:

With the AC input voltage set at 115 volts, rated output current and voltage, the ripple may be observed on the AC vacuum voltmeter or other low bandwidth HI input impedance voltmeter.



SECTION 6 CALIBRATION

Equipment required:

DC Voltmeter Weston 931 series or equivalent

DC Ammeter Weston 931 series or equivalent

MOD Board Extender Part No. 43300

1. With power supply turned OFF, zero the voltage and current meter movements.
2. Turn power ON; set current control to mid-range and voltage controls to full clockwise.
3. Connect a voltmeter to the plus and minus output terminals.
4. Adjust trimpot, R14, on the Regulator Board for the maximum rated output voltage of the unit.
5. Adjust trimpot, R29, on the Regulator Board so that the voltage meter on the front panel is the same as the 1% voltmeter reading.
6. Reduce the voltage output of the unit to about 5 volts and set the current controls to full clockwise.
7. Connect a current meter to the output terminals of the unit.
8. Adjust trimpot, R41, on the Regulator Board for the maximum rated output current of the unit.
9. Adjust trimpot, R28, so that the current meter on the front panel is the same as the 1% current meter.

SECTION 7

TROUBLE SHOOTING

Prior to trouble shooting the supply, it should be returned to the normal mode of operation as described in Section 4, paragraph 4.1 of this manual. Insure that the patch pins are properly placed as shown in Figure 4-1, and that there are no extra patch pins in the Patch Board Connector.

If the unit operates as it should when it is programmed as described in Section 4, paragraph 4.1, return the unit to the desired mode of operation carefully following the Figure which describes the desired mode of operation.

If the supply continues to malfunction check for broken patch pin wires and broken wires within the unit.

7-1 LOAD AND LINE REGULATION OUT OF SPECIFICATION: PROBABLE CAUSE:

- a. Differential voltmeter improperly hooked up. (see Section 5)
- b. A. C. input voltage below minimum operating value. Check A. C. input voltage at power supply input terminals.
- c. Supply in current limiting mode. Check load current.

7-2 HIGH OUTPUT VOLTAGE:

- a. Shorted series regulator transistor.
- b. Shorted driver transistor.

7-3 INPUT FUSE BLOWS:

- a. Rectifiers may be shorted.
- b. Filter or output capacitors may be shorted
- c. Possible shorted turn in transformer

REV	DATE	REVISIONS
A	10/1/54	REL RELEASE REVISION
B	10/1/54	REL RELEASE REVISION
C	10/1/54	REL RELEASE REVISION
D	10/1/54	REL RELEASE REVISION
E	10/1/54	REL RELEASE REVISION
F	10/1/54	REL RELEASE REVISION

MODEL NO	TITLE	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51	Q52	Q53	Q54	Q55	Q56	Q57	Q58	Q59	Q60	Q61	Q62	Q63	Q64	Q65	Q66	Q67	Q68	Q69	Q70	Q71	Q72	Q73	Q74	Q75	Q76	Q77	Q78	Q79	Q80	Q81	Q82	Q83	Q84	Q85	Q86	Q87	Q88	Q89	Q90	Q91	Q92	Q93	Q94	Q95	Q96	Q97	Q98	Q99	Q100	Q101	Q102	Q103	Q104	Q105	Q106	Q107	Q108	Q109	Q110	Q111	Q112	Q113	Q114	Q115	Q116	Q117	Q118	Q119	Q120	Q121	Q122	Q123	Q124	Q125	Q126	Q127	Q128	Q129	Q130	Q131	Q132	Q133	Q134	Q135	Q136	Q137	Q138	Q139	Q140	Q141	Q142	Q143	Q144	Q145	Q146	Q147	Q148	Q149	Q150	Q151	Q152	Q153	Q154	Q155	Q156	Q157	Q158	Q159	Q160	Q161	Q162	Q163	Q164	Q165	Q166	Q167	Q168	Q169	Q170	Q171	Q172	Q173	Q174	Q175	Q176	Q177	Q178	Q179	Q180	Q181	Q182	Q183	Q184	Q185	Q186	Q187	Q188	Q189	Q190	Q191	Q192	Q193	Q194	Q195	Q196	Q197	Q198	Q199	Q200	Q201	Q202	Q203	Q204	Q205	Q206	Q207	Q208	Q209	Q210	Q211	Q212	Q213	Q214	Q215	Q216	Q217	Q218	Q219	Q220	Q221	Q222	Q223	Q224	Q225	Q226	Q227	Q228	Q229	Q230	Q231	Q232	Q233	Q234	Q235	Q236	Q237	Q238	Q239	Q240	Q241	Q242	Q243	Q244	Q245	Q246	Q247	Q248	Q249	Q250	Q251	Q252	Q253	Q254	Q255	Q256	Q257	Q258	Q259	Q260	Q261	Q262	Q263	Q264	Q265	Q266	Q267	Q268	Q269	Q270	Q271	Q272	Q273	Q274	Q275	Q276	Q277	Q278	Q279	Q280	Q281	Q282	Q283	Q284	Q285	Q286	Q287	Q288	Q289	Q290	Q291	Q292	Q293	Q294	Q295	Q296	Q297	Q298	Q299	Q300	Q301	Q302	Q303	Q304	Q305	Q306	Q307	Q308	Q309	Q310	Q311	Q312	Q313	Q314	Q315	Q316	Q317	Q318	Q319	Q320	Q321	Q322	Q323	Q324	Q325	Q326	Q327	Q328	Q329	Q330	Q331	Q332	Q333	Q334	Q335	Q336	Q337	Q338	Q339	Q340	Q341	Q342	Q343	Q344	Q345	Q346	Q347	Q348	Q349	Q350	Q351	Q352	Q353	Q354	Q355	Q356	Q357	Q358	Q359	Q360	Q361	Q362	Q363	Q364	Q365	Q366	Q367	Q368	Q369	Q370	Q371	Q372	Q373	Q374	Q375	Q376	Q377	Q378	Q379	Q380	Q381	Q382	Q383	Q384	Q385	Q386	Q387	Q388	Q389	Q390	Q391	Q392	Q393	Q394	Q395	Q396	Q397	Q398	Q399	Q400	Q401	Q402	Q403	Q404	Q405	Q406	Q407	Q408	Q409	Q410	Q411	Q412	Q413	Q414	Q415	Q416	Q417	Q418	Q419	Q420	Q421	Q422	Q423	Q424	Q425	Q426	Q427	Q428	Q429	Q430	Q431	Q432	Q433	Q434	Q435	Q436	Q437	Q438	Q439	Q440	Q441	Q442	Q443	Q444	Q445	Q446	Q447	Q448	Q449	Q450	Q451	Q452	Q453	Q454	Q455	Q456	Q457	Q458	Q459	Q460	Q461	Q462	Q463	Q464	Q465	Q466	Q467	Q468	Q469	Q470	Q471	Q472	Q473	Q474	Q475	Q476	Q477	Q478	Q479	Q480	Q481	Q482	Q483	Q484	Q485	Q486	Q487	Q488	Q489	Q490	Q491	Q492	Q493	Q494	Q495	Q496	Q497	Q498	Q499	Q500	Q501	Q502	Q503	Q504	Q505	Q506	Q507	Q508	Q509	Q510	Q511	Q512	Q513	Q514	Q515	Q516	Q517	Q518	Q519	Q520	Q521	Q522	Q523	Q524	Q525	Q526	Q527	Q528	Q529	Q530	Q531	Q532	Q533	Q534	Q535	Q536	Q537	Q538	Q539	Q540	Q541	Q542	Q543	Q544	Q545	Q546	Q547	Q548	Q549	Q550	Q551	Q552	Q553	Q554	Q555	Q556	Q557	Q558	Q559	Q560	Q561	Q562	Q563	Q564	Q565	Q566	Q567	Q568	Q569	Q570	Q571	Q572	Q573	Q574	Q575	Q576	Q577	Q578	Q579	Q580	Q581	Q582	Q583	Q584	Q585	Q586	Q587	Q588	Q589	Q590	Q591	Q592	Q593	Q594	Q595	Q596	Q597	Q598	Q599	Q600	Q601	Q602	Q603	Q604	Q605	Q606	Q607	Q608	Q609	Q610	Q611	Q612	Q613	Q614	Q615	Q616	Q617	Q618	Q619	Q620	Q621	Q622	Q623	Q624	Q625	Q626	Q627	Q628	Q629	Q630	Q631	Q632	Q633	Q634	Q635	Q636	Q637	Q638	Q639	Q640	Q641	Q642	Q643	Q644	Q645	Q646	Q647	Q648	Q649	Q650	Q651	Q652	Q653	Q654	Q655	Q656	Q657	Q658	Q659	Q660	Q661	Q662	Q663	Q664	Q665	Q666	Q667	Q668	Q669	Q670	Q671	Q672	Q673	Q674	Q675	Q676	Q677	Q678	Q679	Q680	Q681	Q682	Q683	Q684	Q685	Q686	Q687	Q688	Q689	Q690	Q691	Q692	Q693	Q694	Q695	Q696	Q697	Q698	Q699	Q700	Q701	Q702	Q703	Q704	Q705	Q706	Q707	Q708	Q709	Q710	Q711	Q712	Q713	Q714	Q715	Q716	Q717	Q718	Q719	Q720	Q721	Q722	Q723	Q724	Q725	Q726	Q727	Q728	Q729	Q730	Q731	Q732	Q733	Q734	Q735	Q736	Q737	Q738	Q739	Q740	Q741	Q742	Q743	Q744	Q745	Q746	Q747	Q748	Q749	Q750	Q751	Q752	Q753	Q754	Q755	Q756	Q757	Q758	Q759	Q760	Q761	Q762	Q763	Q764	Q765	Q766	Q767	Q768	Q769	Q770	Q771	Q772	Q773	Q774	Q775	Q776	Q777	Q778	Q779	Q780	Q781	Q782	Q783	Q784	Q785	Q786	Q787	Q788	Q789	Q790	Q791	Q792	Q793	Q794	Q795	Q796	Q797	Q798	Q799	Q800	Q801	Q802	Q803	Q804	Q805	Q806	Q807	Q808	Q809	Q810	Q811	Q812	Q813	Q814	Q815	Q816	Q817	Q818	Q819	Q820	Q821	Q822	Q823	Q824	Q825	Q826	Q827	Q828	Q829	Q830	Q831	Q832	Q833	Q834	Q835	Q836	Q837	Q838	Q839	Q840	Q841	Q842	Q843	Q844	Q845	Q846	Q847	Q848	Q849	Q850	Q851	Q852	Q853	Q854	Q855	Q856	Q857	Q858	Q859	Q860	Q861	Q862	Q863	Q864	Q865	Q866	Q867	Q868	Q869	Q870	Q871	Q872	Q873	Q874	Q875	Q876	Q877	Q878	Q879	Q880	Q881	Q882	Q883	Q884	Q885	Q886	Q887	Q888	Q889	Q890	Q891	Q892	Q893	Q894	Q895	Q896	Q897	Q898	Q899	Q900	Q901	Q902	Q903	Q904	Q905	Q906	Q907	Q908	Q909	Q910	Q911	Q912	Q913	Q914	Q915	Q916	Q917	Q918	Q919	Q920	Q921	Q922	Q923	Q924	Q925	Q926	Q927	Q928	Q929	Q930	Q931	Q932	Q933	Q934	Q935	Q936	Q937	Q938	Q939	Q940	Q941	Q942	Q943	Q944	Q945	Q946	Q947	Q948	Q949	Q950	Q951	Q952	Q953	Q954	Q955	Q956	Q957	Q958	Q959	Q960	Q961	Q962	Q963	Q964	Q965	Q966	Q967	Q968	Q969	Q970	Q971	Q972	Q973	Q974	Q975	Q976	Q977	Q978	Q979	Q980	Q981	Q982	Q983	Q984	Q985	Q986	Q987	Q988	Q989	Q990	Q991	Q992	Q993	Q994	Q995	Q996	Q997	Q998	Q999	Q1000	Q1001	Q1002	Q1003	Q1004	Q1005	Q1006	Q1007	Q1008	Q1009	Q1010	Q1011	Q1012	Q1013	Q1014	Q1015	Q1016	Q1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SECTION 9

RECOMMENDED SPARE PARTS LIST

<u>Box No.</u>	<u>Description</u>	<u>Value or Part No.</u>	<u>Qty</u>
848	Transistor	2N4248	3
828	Transistor	2N1711	1
846	Transistor	2N3904	3
824	Transistor	2N1132	1
843	Transistor	2N3715	5
847E	Transistor (specify supply)	MJ 413	1
249A	Diode	MR1121	1
237	Diode	1N759A	1
234	Diode	1N753A	1
244F	Diode	1N4003	1
239	Diode	1N914	3
154	Capacitors	500uf, 50v	1
145B	Capacitors	50uf, 50v	2
142	Capacitors	10uf, 25v	2
135	Capacitors	5uf, 50v	1
116	Capacitors	2uf, 50v	1
359	Potentiometer	10k	2
349	Potentiometer	5k	2
247	Rectifier Bridge	MDA-962-3	1
245A	Rectifier Bridge	MDA-942A-2	1
	Filter Capacitors (specify supply)		1
	Meter	30575	1
488	Resistor, 1/4w 1%	1 meg	1
471C	Resistor, 1/4w 1%	40.2k	1
451	Resistor, 1/4w 1%	6810	1
478K	Resistor, 1/4w 1%	182k	1
459	Resistor, 1/4w 1%	12.4k (Assy 42074)	1
450	Resistor, 1/4w 1%	6340 (Assy 42075)	1
429	Resistor, 1/4w 1%	2610 (Assy 42076)	1
446	Resistor, 1/4w 1%	5490	1
436B	Resistor, 1/4w 1%	3320	1
420	Resistor, 1/4w 1%	1740	1
409	Resistor, 1/4w 1%	1k	1
607H	Resistor, 2w 10%	68 (Assy 42074)	2
607E	Resistor, 2w 10%	220 (Assy 42075)	2
610M	Resistor, 2w 10%	800 (Assy 42076)	2

ASSEMBLIES

Regulator Board (assembled)	Assy 42074, 42075, 42076	1
Resistor Board (assembled)	Assy 41114 (specify supply)	1
Pass Transistor Assembly (assembled)	Assy 42086 (specify supply)	1
Fan Assembly (assembled)	Assy 42051 (specify supply)	1
Transformer	(specify supply)	1

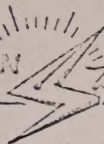
1 November 1968

Prices subject to change without notice

Minimum order charge of \$25.00

Please order by Box Number

PRECISION



Standards CORP.

P.O. BOX 8561 SAN MARINO, CALIF.

SECTION VI

WARRANTY

The PRECISION STANDARDS CORPORATION warrants each instrument to be free from defects in material and workmanship. The instrument must be returned to the factory with shipping prepaid and a complete report of the difficulty. This warranty is good for one year from the shipping date.

SHIPPING DAMAGE

If there is any damage to the instrument upon receipt, report this to the transportation claim agent immediately.

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